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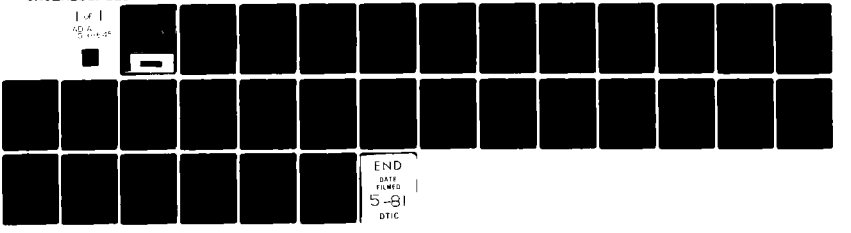

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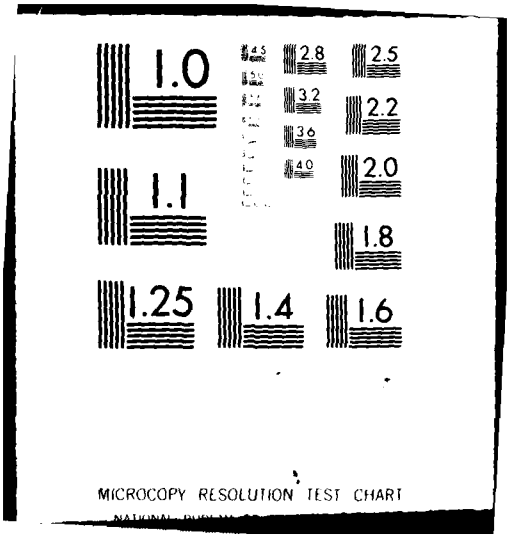
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Publication 1377-01-TR-2288

TASK 5 REPORT

RECOMMENDATION OF PREFERRED INTERFACE PROCEDURES WORLDWIDE CRISIS ALERTING NETWORK, PHASE II

September 1980

Prepared for
DEFENSE COMMUNICATIONS AGENCY
WASHINGTON, D.C. 20305
under Contract DCA100-80-C-0010

ARINC RESEARCH CORPORATION

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

ARINC Research Corporation is developing a system architecture for the Phase II Worldwide Crisis Alerting Network (WCANII). The objective of the program is to provide communication connectivity between specified U.S. and allied military and civilian subscriber groups.

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Prepared by

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EXECUTIVE SUMMARY

This fifth task report reviews the subscriber communications system assessment methodology and describes the WCAN II subscriber communication systems/AUTODIN interface configurations and preferred system interface procedures.

The pertinent findings in this report are as follows:

- The subscriber communications system/WWMCCS interface assessments arrived at in Task 3 are valid.
- The estimation of the interface development resources developed in Task 4 are reasonable.
- The preferred interface procedures are essentially those developed in Task 3, modified to employ more efficient methods by utilizing a designated AUTODIN message center equipped with specific telephone and Telex numbers and a registered cable address.

In summary, it continues to appear that the WCAN II concept is valid and would contribute significantly to the reporting of crisis events by qualified personnel.

CONTENTS

CHAPTER ONE

INTRODUCTION

ARINC Research Corporation is developing a system architecture for the Phase II Worldwide Crisis Alerting Network (WCAN II) under contract DCA100-80-C-0010 for the Defense Communications Agency. The objective of the program is to identify alternative procedures and means to provide communications connectivity between specified U.S. and allied military and civilian subscriber groups. The effort encompasses the simplification and standardization of the means associated with the submission of crisis alerting messages so that they can be handled more reliably and expeditiously than is currently possible. The objectives of this project are to examine the telecommunications systems currently serving each subscriber group and, for each such telecommunications system, postulate interface means and procedures. The resulting modification of interface means and procedures will permit incidents that are first recognized outside the military, to be reported quickly and efficiently to the proper authorities.

Four previous interim reports have been prepared which covered the activities associated with Task 1 (Review of Related Work), Task 2 (Identification of Existing Communications Systems), Task 3 (Assessment of WWMCCS Interfaces) and Task 4 (Estimation of Interface Development Resources. This report addresses the results of our effort in Task 5 (Recommendation of Preferred Interface Procedures).

1.1 OBJECTIVES OF TASK 5

The primary purpose of this fifth task, "Recommendation of Preferred Interface Procedures", is to summarize the interface procedure recommendations developed in Task 3 and update those procedures based on additional information developed during the conduct of Task 4 and Task 5. The results of this task will serve as input to Tasks 6 (Development of WWMCCS Interface Implementation Concept) and 7 (Preparation of Final Report).

1.2 CONDUCT OF TASK 5

The conduct of Task 5 encompassed the performance of the following three subtasks:

- Develop Evaluation Methodology

This subtask required careful review of the evaluation methodology developed and applied in Task 3. This technical evaluation was supplemented by interviews with selected organizations (e.g., FAA, USCG, ARINC, COMSAT General) in order to confirm the results of the evaluation methodology. This subtask also included a review and configuration of the ability of each subscriber communications system to meet the WCAN II technical and operational requirements described in the Task 3 report.

- Perform System Comparison and Identify Optimum WCAN II System Configuration

Performance of this subtask required more detailed study of the various subscriber communications systems which were described in Task 2 and evaluated in Task 3. Where applicable, system comparisons were re-evaluated and the individual subscriber communications system evaluation criteria examined to ensure their validity.

- Prepare Preferred Interface Recommendations Report

This report is the result of the completion of this task. The basic information used in this task was developed in Tasks 2, 3, and 4, and supplemented by interviews with selected subscribers.

1.3 ORGANIZATION OF THE REPORT

Chapter One of this report has served as an introduction to the Task 5 effort (Recommendation of Preferred Interface Procedures). Chapter Two discusses the subscriber communications system evaluation methodology, the selection of the systems which meet the WCAN II technical criteria and describe an optimum WCAN II configuration. Chapter Three presents a detailed description of the WCAN II system in terms of the subscriber communications systems serving aircraft, vessels, non-DOD government agencies, offshore oil platforms and NATO. Chapter Four provides recommendations for the subscriber communications system/AUTODIN interfaces. Finally, Chapter Five summarizes the conclusions reached as a result of performing the Task 5 effort.

CHAPTER TWO

SYSTEM ASSESSMENT METHODOLOGY AND SELECTION OF OPTIMUM WCAN II

2.0 INTRODUCTION

This chapter reviews the system assessment methodology and selection of the optimum WCAN II configuration developed in Task 3, "Assessment of WWMCCS Interfaces".

2.1 SYSTEM ASSESSMENT METHODOLOGY

The subscriber communications system assessments in Task 3 were reviewed to determine that the evaluation methodology used was still applicable and the results of the assessments were valid. The Task 3 report addressed six requirement factors that were developed to describe the ability of a subscriber communications system to meet the WWMCCS interface requirements. The requirement factors were assigned weights which were reviewed with and agreed to by CCTC and WSEO representatives. The agreed-upon requirement factors and associated weights are as follows:

Requirement Factor	Weight
. Institutional/Political/Regulatory	0.35
. Availability	0.25
. AUTODIN Message Center Accessibility	0.15
. Geographical Coverage	0.10
. Timeliness	0.08
. Transmission Quality	0.07

A detailed description of each requirement factor is contained in the Task 3 report beginning on Page 3-2.

The requirement factor indexes (Task 3 report, pages 3-4, 5, 6) which indicate the degree to which a subscriber communications system meets the requirement factor were also reviewed. Based on the results of these reviews, each system score was recalculated. In each case, the subscriber system scores remained unchanged as follows:

- Airline Systems

System	Score
FAA	8.96
ARINC	8.46
AFTN	6.38
SITA	4.75

- Maritime Systems

MARISAT	10.00
USCG	9.20
Offshore Oil Rigs	8.50
Commercial MF/HF/VHF	5.66

- NATO System

NATO	5.30

It should be noted that approximately 100 additional U.S. and NATO-ally vessels have been equipped with MARISAT terminals since the date of the list used to generate the Task 2 report. While these additions do not change the MARISAT system score, the additions do indicate the increasing value of MARISAT to WCAN II.

2.2 OPTIMUM WCAN II SYSTEM CONFIGURATION

As described in the Task 3 report, the optimum WCAN II system configuration will consist of all the subscriber communications evaluated with the

exception of SITA. The current Institutional/Political/Regulatory problems which would have to be overcome, while not insurmountable, would require a long-term effort to resolve the SITA interconnect problem.

All of the subscriber communications systems currently have the capability of interfacing directly or indirectly with AUTODIN as follows:

AUTODIN DIRECT	AUTODIN INDIRECT
FAA	ARINC
USCG	AFTN
NATO	MARISAT
	Commercial MF/HF/VHF
	U.S. off-shore Oil Rigs

While the deficiencies of an indirect AUTODIN interface for the five subscriber communications systems listed can be overcome in the future, they could function effectively as a part of WCAN II in their present configurations. Taking into account the "no new hardware" constraint, the optimum WCAN II system configuration consisting of the eight subscriber communications systems would provide timely, worldwide coverage.

CHAPTER THREE

DESCRIPTION OF WCAN II SYSTEM CONFIGURATION

3.0 INTRODUCTION

The description of the WCAN II system configuration is shown schematically in Figures 3-1 through 3-6. Figure 3-1 presents the WCAN II general system configuration which includes interfaces of commercial aircraft, commercial vessels, non-DoD government agencies, offshore oil platforms and NATO communications systems with AUTODIN. The various types of communications flowing in the system are as follows:

- Crisis Alert Message (CAM)
- Acknowledgement (A) of CAM receipt
- Query (Q) requesting additional information
- Response (R) to the query

3.1 COMMERCIAL AIRCRAFT COMMUNICATIONS

Figure 3-2 shows the CAM HF voice transmission from an aircraft to the FAA, ARINC or AFTN systems with onward transmission via teletypewriter (TTY) to the FAA/AFTN switch in Kansas City. The FAA enters the CAM at the FAA AUTODIN Message Center (AMC) which acknowledges CAM receipt via HF voice and transmits the CAM into AUTODIN. The CAM is distributed automatically within AUTODIN at which time command of continuing communications is assumed by the CONTROL AMC.

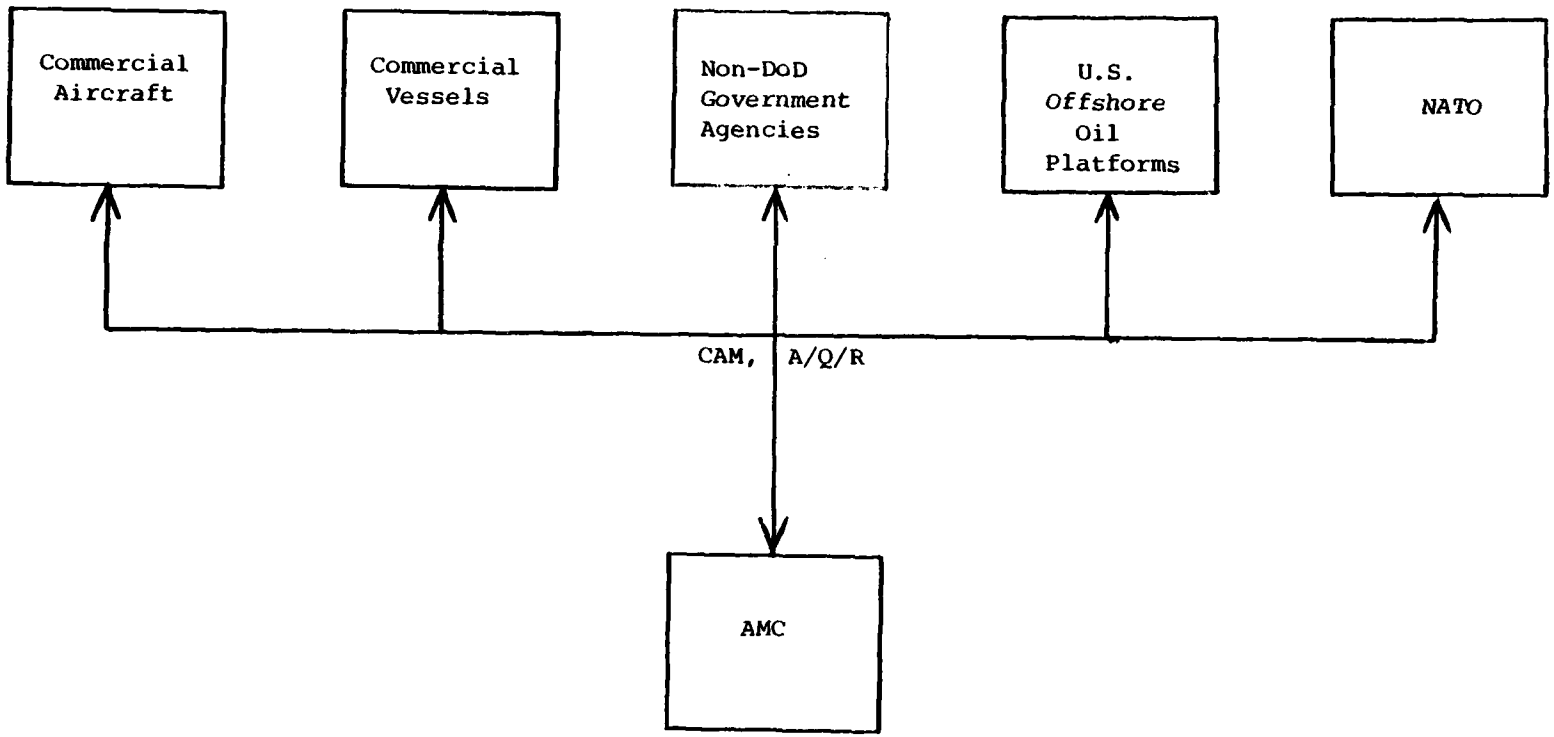

Figure 3-1. WCAN II GENERAL SYSTEM CONFIGURATION

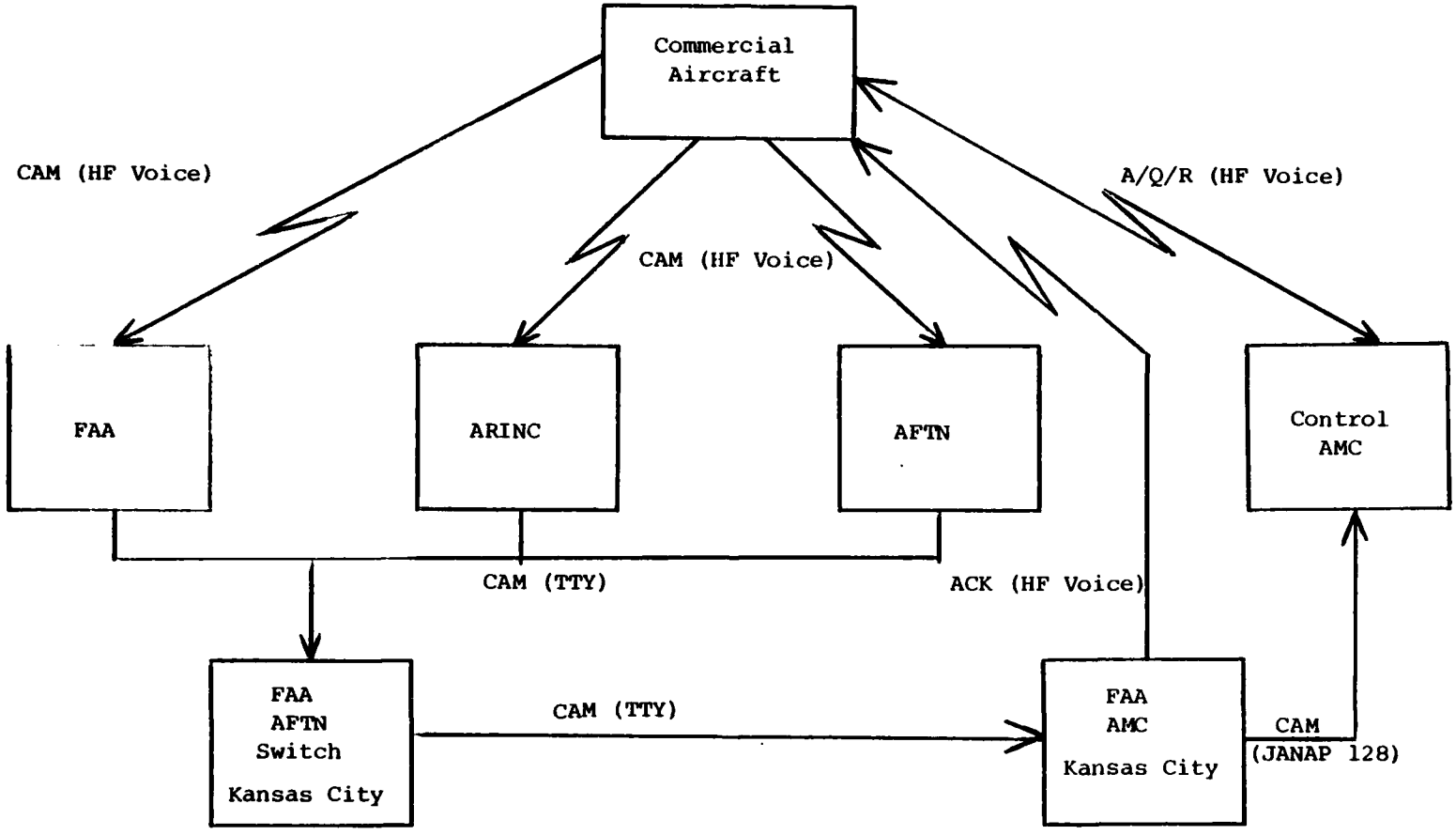

Figure 3-2. WCAN II COMMERCIAL AIRCRAFT COMMUNICATION, U. S. AND NATO-ALLY

3.2 COMMERCIAL VESSEL COMMUNICATIONS

Commercial Vessels may communicate via satellite (MARISAT), Commercial MF/HF/VHF radio and via the U.S. Coast Guard (USCG) in morse, TELEX or voice modes (Figure 3-3). CAMs sent by MARISAT or commercial means are directed to a Designated AMC equipped to handle telephone, TELEX or cable messages. The Designated AMC acknowledges CAM receipt via HF (voice or TELEX) and transmits the CAM into AUTODIN. The USCG may be in direct communications with the vessel and transmit the CAM into AUTODIN from one of its AMCs. In all cases, as described in Section 3.1, the Control AMC carries out all continuing communications.

3.3 NON-DoD GOVERNMENT AGENCIES

Both the FAA and USCG systems (Figure 3-4) interface with AUTODIN via on-premises terminals. The communications for the FAA and USCG are described in Section 3.1 and 3.2, respectively.

3.4 U.S. OFFSHORE OIL PLATFORMS

Figure 3-5 shows the communications flow for the U.S. offshore oil platforms. The oil platforms, outside territorial limits, communicate in the same manner as vessels described in Section 3.2.

3.5 NATO SYSTEMS

The WCAN II/NATO communications shown in Figure 3-6 indicate that there are existing NATO/AUTODIN interfaces located in the U.S. and in Europe. A detailed description of the complexities of NATO communications together with a description and schedule of enhancements is detailed in Section 2.5 (NATO Communications Systems) of the Task 2 report. The NATO system includes

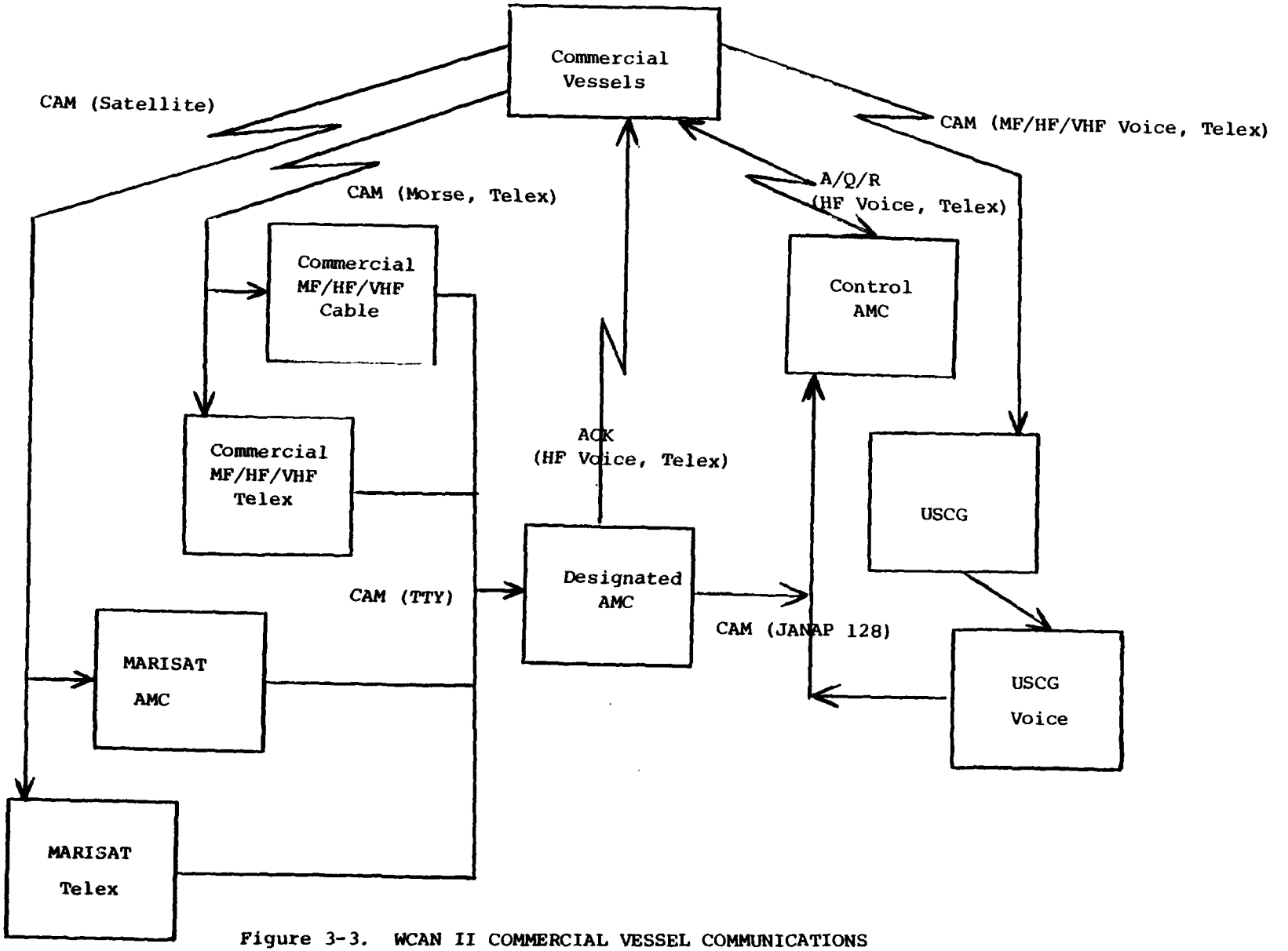

Figure 3-3. WCAN II COMMERCIAL VESSEL COMMUNICATIONS U. S. AND NATC-ALLY

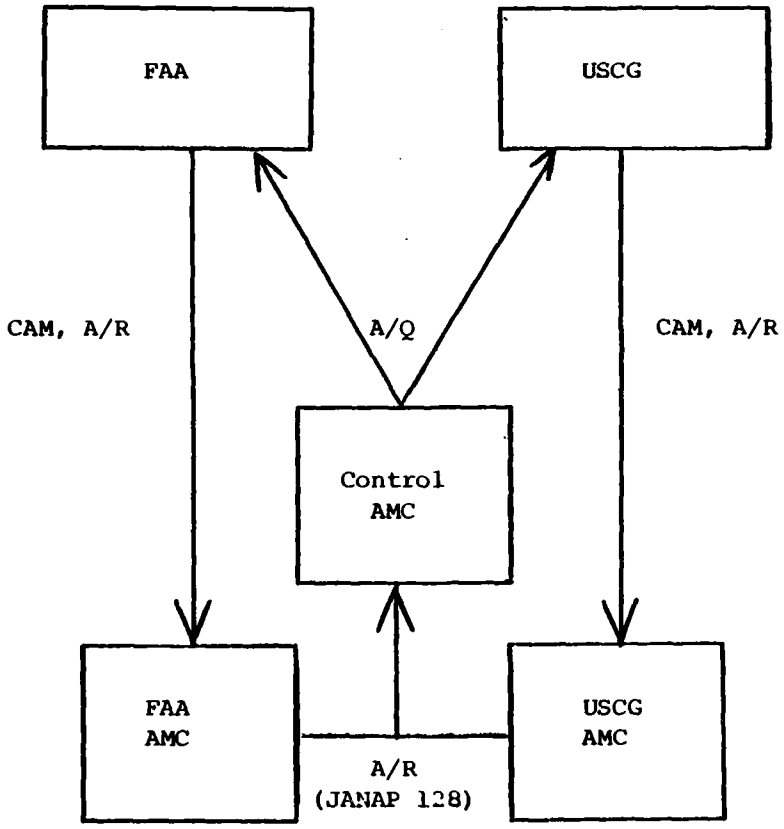

Figure 3-4. WCAN II NON-DoD GOVERNMENT AGENCY COMMUNICATIONS

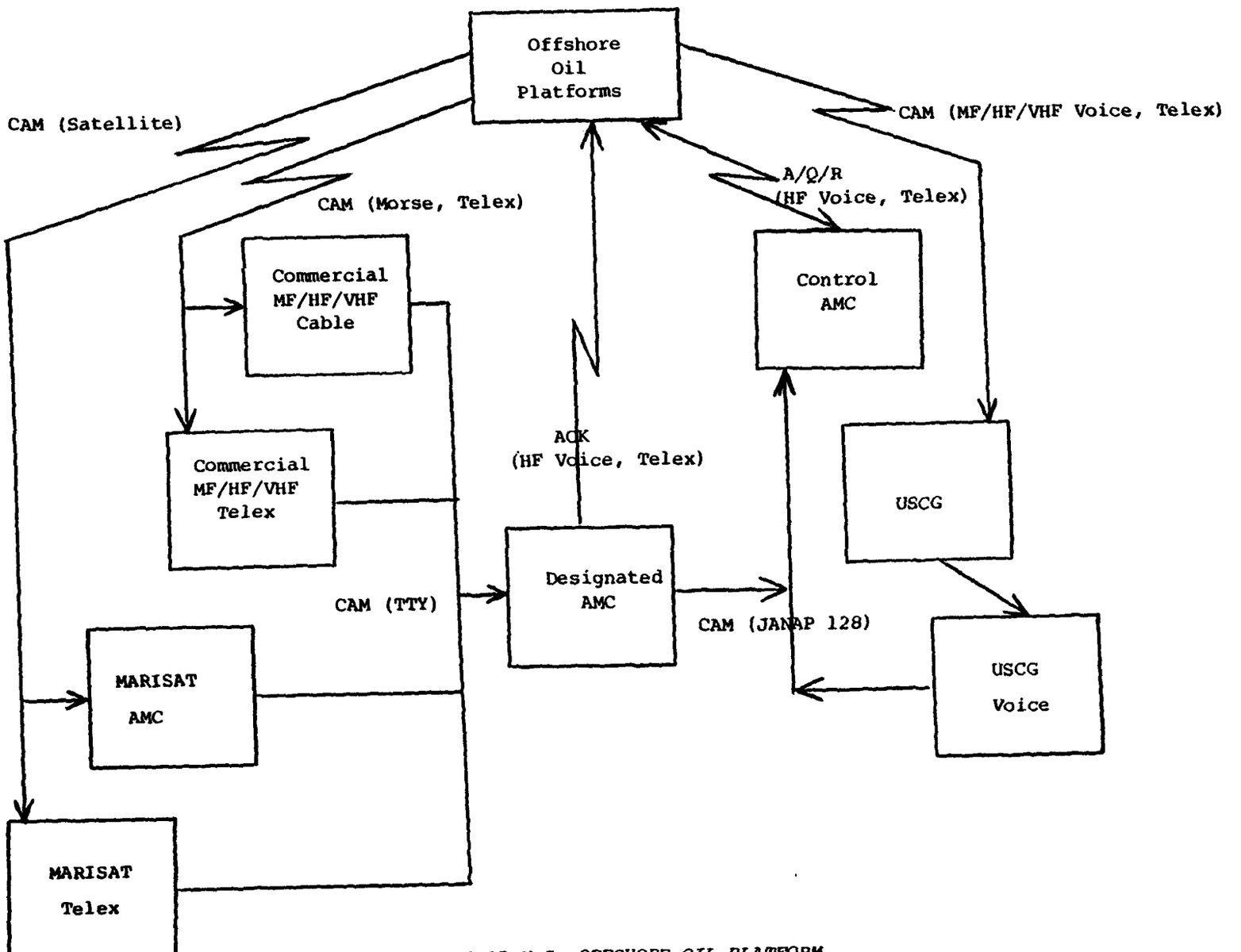

Figure 3-5. WCAN II U.S. OFFSHORE OIL PLATFORM COMMUNICATIONS

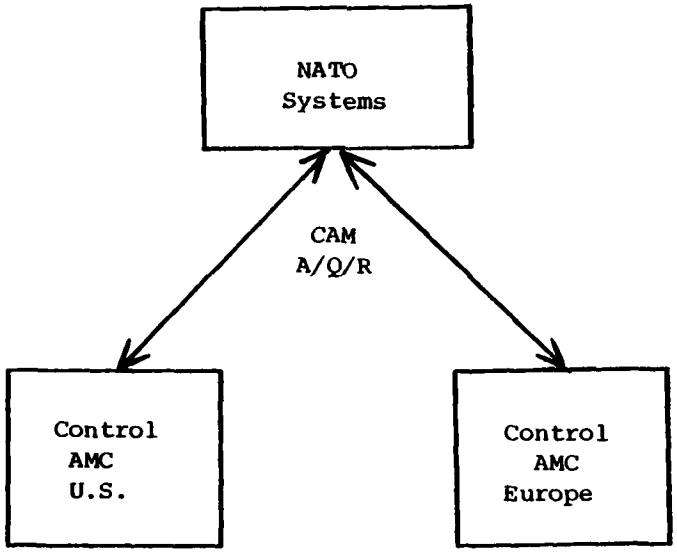

Figure 3-6. WCAN II - NATO SYSTEMS COMMUNICATIONS

both Stages I and II of the NATO Integrated Communications System (NICS). The simplified schematic indicates that interoperability with AUTODIN is possible but there are still deficiencies as noted in Chapter Four of this report.

CHAPTER FOUR

SUBSCRIBER COMMUNICATIONS SYSTEM/AUTODIN INTERFACES

4.0 INTRODUCTION

This chapter summarizes the results of an evaluation of WCAN II/subscriber communications system interfaces with the AUTODIN network. Three discussion topics are presented in this chapter as follows:

- Interface selection rationale and recommendations
- Degree to which each selected interface and the entire system meets the WCAN II requirements
- Interface procedures implementation recommendations

4.1 INTERFACE SELECTION RATIONALE AND RECOMMENDATIONS

In accordance with the guidance given in the MEP (Ref. 1) and Annex G (Ref. 2) for the WCAN Phase II development, the interface requirements between individual subscriber communications systems (FAA, ARINC, MARISAT, etc.) and the AUTODIN network address only operational interface procedures. These communications interface procedures, either voice or record modes, are depicted in the WCAN II Functional Flow diagram (Fig. 6-3) of the WCAN II Task 3 Report (Ref. 3). The connectivity of the various subscriber systems to the AUTODIN network in the ALERT transaction analysis diagram is: (a) from a report origination station (ROS) to a relay/switching station (RSS), (b) from a RSS to an AUTODIN message center (AMC), and (c) from a ROS to an AMC.

Generalized connectivity diagrams of report origination stations (commercial airlines, commercial vessels, non-DoD agencies, U.S. offshore oil rigs, and NATO), subscriber communications systems and AUTODIN message centers are shown in Figures 3-1 through 3-6 .

Specific formats have been proposed in the WCAN II Functional Flow Diagram (Ref. 3). Basically, the formats from each ROS or RSS to the upward station shall include: (a) DD ALERT prosign, (b) destination address code/number, (c) origination address code/number and location and (d) a free text describing the nature of the crisis, including the time, the place, the parties involved, etc.

No "DD ALERT" prosign will be used for those return messages such as ALERT acknowledgement and query. Any message with the "DD ALERT" prosign is to be handled as a message that has a FLASH preemption capability in the AUTODIN system. An ALERT return message is to be handled as an IMMEDIATE or PRIORITY precedence level message, dependent upon the nature of the cirsis situation. Both the origination and destination of the message format must be identified by the name of the platform/station, TELEX/TWX number, telephone number address codes, etc.

These WCAN II reporting formats must be readily available to operators of each WCAN II ROS and RSS for a crisis situation. The point of contact shall be clearly identified for the operator to contact all available RSS's, ROS's and AMC's in the immediate area by:

(a) TWX/TELEX number

(b) Cable Address

(c) Telephone number

(d) FAA, ARINC, and AFTN code addresses where applicable.

4.2 DEGREE TO WHICH EACH SELECTED INTERFACE AND THE ENTIRE SYSTEM MEET THE WCAN II REQUIREMENTS

Due to operational characteristics of the existing subscriber communications system, WCAN II performance requirements are redefined in Sec. 2.2 of WCAN II Task 3 Report (Ref. 3). Specific WWMCCS interface requirements factors stated in the above reference are: institutional/political/regulatory considerations, availability, AUTODIN message center accessibility, geographical coverage, timeliness, and transmission quality. Furthermore, the performance measure of WCAN II subscriber communications systems is defined as a weighted average of the abovementioned six requirement factors. These factors and their respective weights were reviewed with DCA/CCTC and DCA/WSE representatives. The required performance value of each subscriber communications system to satisfy WWMCCS requirements is ten (10). All performance values below 10 indicate some degree of deficiency. The deficiencies of each subscriber communications system recommended as part of the WCAN II configuration are summarized below:

FAA NETWORK - The deficiency of the FAA network (score of 8.96) as a WCAN II subscriber communications system is due to the limited geographical coverage in the North Pacific area which serves less than 50% of international flights. This deficiency cannot be readily corrected for the WCAN II since the geographical coverage of the FAA network is predetermined for its own use.

ARINC - The deficiency of ARINC (score of 8.46) is due to: the limited geographical coverage in the North Atlantic and the Pacific areas which serves over 50% of international flights, poor AMC access via CONUS link for message delivery, and poor transmission quality of the extended HF

service range requiring oral verification of message text. Both the geographical coverage and the HF service range problems cannot be readily corrected for the *WCAN II for the same reason as explained in the previous* paragraph. The AMC accessibility problem can be corrected by installing an ARINC terminal at an AMC or an AUTODIN terminal at key gateway stations of the ARINC system.

AFTN - The deficiencies of AFTN (score of 6.38) are due to: institutional/political/regulatory problems anticipated at some foreign government-operated AFTN stations in transmitting messages to AUTODIN; poor AUTODIN message center accesibility because air/ground transmissions must be switched from AFTN to FAA to an AMC; and poor transmission quality because degradation over HF link and some foreign landline circuits indicate a 50% to 59% message quality for worldwide service.

MARISAT - No deficiencies (score of 10.0)

USCG - The deficiency of the USCG system (score of 9.2) is due only to a geographical coverage problem of MF/HF/VHF in its operational areas.

OFFSHORE OIL RIGS - The deficiency of offshore oil rigs (score of 8.50) is primarily due to the AMC accessibility, since messages may be transmitted either via CONUS links using MARISAT or via HF/VHF to CONUS from their fixed location. The AMC accessibility for offshore oil rigs can be improved by direct connection with some of the major international oil company subscriber communications system to an AMC (after a detailed study).

COMMERCIAL MF/HF/VHF - The deficiencies of commercial MF/HF/VHF radio services (score of 5.66) are due to: poor AMC accessibility because the message and voice connections may require multiple switching via foreign shore stations, poor timeliness because the average transmission time may

exceed 1 hour as a result of radio transmission from various global shipping lanes, poor transmission quality of MF/HF radio link, and institutional/ political/regulatory problems, which can be anticipated at foreign shore stations when a vessel is in port and required to communicate via the local communication carrier.

NATO - The deficiencies of the NATO subscriber communications system (score of 5.30) are due to: institutional/political/regulatory problems since each NATO member would have to authorize the use of their portion of network for the ALERT message transmission to AUTODIN, and poor timeliness because present communications systems in NATO countries are frequently overloaded resulting in transmission delay in excess of one hour.

4.3 INTERFACE PROCEDURES IMPLEMENTATION RECOMMENDATIONS

The purpose of this section is to describe the procedures necessary to implement the subscriber communication systems/AUTODIN interface procedures. The recommended subscriber communications system/AUTODIN interface procedure is to transmit on ALERT message in either voice or record mode in a format which contains the: "DD ALERT" prosign, destination address code/number, origination address code/number, and a free text describing the nature of the crisis including the time, the place, the parties involved, etc. Both the origination and destination address code/number must be complete and include the name of the platform/station, TELEX/TWX numbers, address codes, etc.

Implementation agreements and arrangements for these interface procedures can be made in the same manner as the basic agreement and arrangement with commercial airlines, commercial vessels, non-DoD agencies, NATO and communications common carriers as explained in Section 2 of WCAN Task 4 Report (Ref. 4) as amended. Specific items to be considered are as follows:

. Additional telecommunications facilities at selected AMC's - As discussed in Sec. 4.2, one of the major deficiencies of various subscriber communications system is the accessibility to an AMC. An implementation recommendation is to install additional telecommunications facilities such as direct telephones, TELEX, and registered cable address at selected AMC's, enabling easier access to AUTODIN by vessels and offshore oil platforms using commercial MF/HF/VHF services. The telephone and TELEX facilities will require a one-time expenditure for installation and a recurring operating cost. The Registered Cable Address requires an initial registration charge and an annual charge for continuing registration.

. Modifications to subscriber communications system procedures - For commercial airlines, the modification required consists primarily of the addition of a station address code to direct messages from aircraft to the AMC located at the FAA/AFTN switching center in Kansas City. New address codes will be required for AFTN, ARINC, and FAA.

For off-shore oil rigs, the modification required may also consist of the addition of a station address code to direct the message between offshore oil rigs and their individual international oil company network to a mutually agreed-upon designated AMC.

For commercial MF/HF/VHF, the modifications required consist of: the assignment of a registered cable address code; and with commercial MF/HF/VHF services, to install a ring-down telephone number (voice circuit) at selected AMC's. The private ring-down telephone may require special agreement and arrangement with the commercial MF/HF/VHF services, the local

communications carrier and foreign PTTs, where necessary.

. Procedural modifications of selected AMC's - The above two major modifications assume that a limited number of AMC's will require trained designated (rather than dedicated) operators to handle and relay ALERT messages to the appropriate ASC. A designated AMC operator for WCAN II will have the responsibility to process ALERT messages and maintain contact with a ROS in addition to his normal duties. The rationale for designating rather than dedicating an AMC operator is: the associated costs and the sporadic nature of ALERT message traffic.

CHAPTER FIVE

CONCLUSIONS

WCAN II continues to appear to be a very cost effective approach to providing timely, worldwide crisis reporting coverage by competent individuals. The preferred interface procedures recommended are relatively easy to achieve and are in line with the WCAN I concept.

The development of WCAN II operational procedures to be used in a pilot system test would serve to prove the operational capabilities of the WCAN II program.

APPENDIX A

REFERENCES

1. DCA, "Management Engineering Plan for the Worldwide Crisis Alerting Network," 15 March 1980.

2. DCA/WWMCCS System Engineering Organization, Annex G, "Worldwide Crisis Alerting Capability Transition Plan (U)," June 1977.

3. ARINC, "Assessment of WWMCCS Interfaces, Worldwide Crisis Alerting Network, Phase II," Task 3 Report, June 1980, 1377-01-TR-2203.

4. ARINC, "Estimation of Interface Development Resources, Worldwide Crisis Alerting Network, Phase II," Task 4 Report, August 1980, 1377-01-TR-2236.

APPENDIX B.

LIST OF ABBREVIATIONS AND ACRONYMS

AIG	Address indicator group
AFTN	Airline Fixed Telecommunications Network
ALERT	The Prosign for the AUTODIN, used for crisis alerting
AMC	AUTODIN message center
AMRIL	AUTODIN message routing indicator list
ASC	AUTODIN switching center
ASCII	American Standard Code for Information Interchange
ARINC	Aeronautical Radio Inc.
AUTODIN	Automatic Digital Network
BT	A "Break" in the AUTODIN line format to separate a line from the next line
CAM	Crisis Alert Message
CCTC	Command and Control Technical Center
CIC	Communication Indicator Code
COMSEC	Communication Security
CONUS	Continental US
CR	Carriage return
CRITIC	A sentinel of the AUTODIN message; Critical intelligence communications
DCS	Defense Communication System
DD ALERT	A sentinel of the AUTODIN message
DTGZ	Date-time group ZULU

EOM	End-of-Message
FAA	Federal Aviation Administration
FIGS	FIGURES: Upshift in TTY code
FL	AUTODIN format line
GCT	Greenwich Civil Time
GMT	Greenwich Mean Time
GENSER	General Service in the AUTODIN
HF	High frequency 3 - 30 MHz
IF/F	Identify friend or foe
JANAP 128	JCS document on AUTODIN operating procedures
LF	Line feed
LTRS	LETTERS: Downshift in TTY code
MARISAT	Maritime Satellite Organization
MEP	Management Engineering Plan
MF	Medium Frequency 300kHz-3 MHz
NATO	North Atlantic Treaty Organization
NAVCOMSTA	Naval Communication Station
OSRI	Orgination Station Routing Indicator
OSSN	Origination Station Serial Number
Q/R	Query/Response
RI	Routing Indicator
ROS	Report orininating station
R/SS	Relay/ switching station
SITA	Societe Internationale de Telecommunications Aeronautiques
SSN	Station serial number
SSN	Sun Spot Number
TI	Transmission Indicator

TTY	Teletypewriter
USCG	United States Coast Guard
VHF	Very high frequency 30-300 MHz
WCAN	WWMCCS Crisis Alerting Network
WSEO	WWMCCS Systems Engineering Organization
ZNR	A Security Warning Operating Signal; Unclassified
ZNY	A Security Warning Operating Signal; Classified
ZULU	Time Zone "Z", the same as GMT


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